MULTIMEDIA UNIVERSITY

STUDENT IDENTIFICATION NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2017/2018

BDE2014 – DIFFERENTIAL EQUATIONS

(All Sections / Groups)

04 JUNE 2018
9.00 A.M – 11.00 A.M
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of 2 pages excluding cover page.
2. Attempt all 4 questions. The distribution of marks for each question is given.
3. Students are allowed to use scientific calculators.
4. Please write your answers in the **Answer Booklet** provided.

Question 1

a) Solve the following differential equation using the separable equation method:

$$(1+x)dy - ydx = 0$$ (6 marks)

b) Show that the following differential equation is exact, and find the general solution:

$$(e^{2y} - y\cos xy)dx + (2xe^{2y} - x\cos xy + 2y)dy = 0$$ (9 marks)

c) Consider the following differential equation (DE):

$$x\frac{dy}{dx} + 5y = x^3 - 1$$

(i) Rewrite the DE in the form of $\frac{dy}{dx} + p(x)y = r(x)$ (2 marks)
(ii) From (i), find its integrating factor. (3 marks)
(iii) Hence, find the general solution of the DE. (5 marks)

Question 2

a) Solve the following Bernoulli differential equation:

$$\frac{dy}{dx} = y(xy^3 - 1)$$

(10 marks)

b) Consider the following differential equation (DE) using Undetermined Coefficient-Superposition Approach:

$$y'' + 6y' + 8y = 2x + e^{-x} \qquad y(0) = 0; \qquad y'(0) = 0$$

(i) Find the complementary function, y_h of the above DE (4 marks)
(ii) Find the particular function, y_p of the above DE (6 marks)
(iii) Find the general equation, y of the above DE (5 marks)

Continued.....

Question 3

a) Find the general solution for the following non-homogenous Cauchy-Euler equation by using variation of parameters method:

$$x^2y'' - 3xy' + 3y = 2x^4e^x$$

(18 marks)

b) Find the partial differential equation by eliminating the arbitrary constants from the

$$z = (x^2 + a)(y^2 + b)$$

(7 marks)

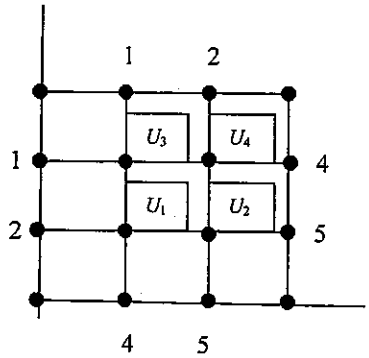
Question 4

a) Classify the following partial differential equations as hyperbolic, parabolic, or elliptic. Here $x > 0$, $y > 0$.

(i) $\mu_{xx} + \mu_{xy} + \mu_{yy} - 7\mu_y = 0$ (3 marks)
(ii) $\mu_{xx} + 6\mu_{xy} = -9\mu_{yy}$ (3 marks)
(iii) $\mu_{xx} = 9x\mu_{xy}$ (3 marks)

b) Given the values of u (x,y):

$$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 2x + 2y$$



(i) With mesh length, h =1 for the square as in figure above, and assume that (u_2, u_3, u_4) = (0, 0, 0), find the initial values of u.

(6 marks)

(ii) Improve the values in (i) using Gauss-Seidel iteration. Iterate the process up to three iterations. (Use 4 decimal places for all the workings).

(10 marks)

End of paper